

(19) FEDERAL REPUBLIC
OF GERMANY



GERMAN
PATENT OFFICE

(12) German Patent

(11) DE 33 20 821 C1

(21) Application No.: P 33 20 821.2-31

(22) Filing Date: June 9, 1983

(43) Disclosure Date: -

(45) Publication Date of Granted Patent:
January 3, 1985

(51) Int. Cl.³:

H 04 R 1/02

G 10 K 9/12

B 06 B 1/06

Opposition can be filed within 3 months after publication of the granted patent.

(73) Patent Holder:

Eichhoff Werke GmbH,
6407 Schlitz, Germany

(72) Inventor:

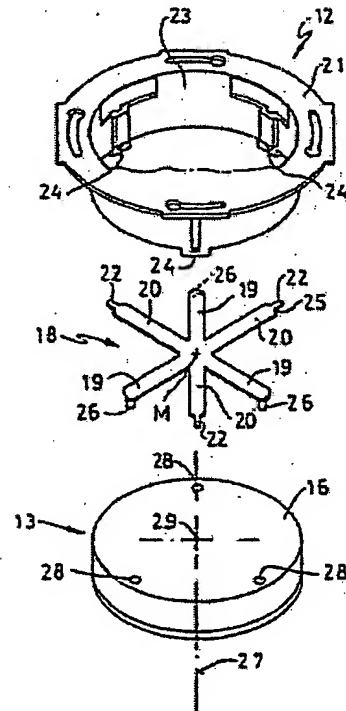
Alfred Fritsch, 6423 Wartenberg, Germany
Hans Heinrich Lohn, 6407 Schlitz, Germany

(56) Publications cited in opposition in the
examination proceedings under § 44 of the
[German] Patent Act:

German Patent 20 52 443

(54) Electroacoustic Device

Electroacoustic device in an electroacoustic device having a plastic spring element (18) which is arranged between the device housing (12) and the housing (16) of an electroacoustic transducer (tone generator 13) and can be connected to both as a plug connection and which functions as a decoupling element, an arrangement is to be achieved in particular for use in a so-called "second alarm" so that it takes up little axial space and permits simple manufacture of the spring element (18) by injection molding technology. This is accomplished essentially by designing the spring element (18) as a multi-arm star, whereby all the arms (19 and 20) are provided alternately with plug prongs (22, 26) for connecting to the device housing (12) on the one hand and the transducer housing (16) on the other hand. All the arms (19, 20) of the spring element (18) are preferably situated essentially in the same plane in order to achieve an extremely flat construction. The plug connection of the spring element (18) to the device housing (12) on one hand and to the transducer housing (16) on the other hand is accomplished with a prestress, so that the spring element (18) is deflected and prestressed in a manner which results in a distance between the housings (12, 16).



Patent Claims:

1. An electroacoustic device having a device housing and an electroacoustic transducer, where the housing of the transducer and the device housing are joined together and held a distance apart from one another in a resonance-free manner by means of a plastic spring element connectable to them by a plug connection, characterized in that the spring element (18) is designed as a multi-arm star, wherein all the arms (19; 20) are provided alternately with plug prongs (22; 26) for connecting to the device housing (12) on the one hand and to the transducer housing (16) on the other hand.

2. The device according to Claim 1, characterized in that all the arms (19; 20) of the spring element (18) lie essentially in the same plane.

3. The device according to Claim 1, characterized in that the plug prongs (22; 26) are arranged on the free ends of the arms (19; 20) of the spring element (18) and are designed as tapered arms (19; 20) to extend in the radial direction and/or as arms extending across the plane of the star.

4. The device according to Claims 1 through 3, characterized in that the star has six arms (19; 20) of which alternately one arm (19) on the free end has a tapered prong (22) running radially and the other arm (20) has a peg (26) protruding away from the plane of the star and one of the two housings (12 or 16) is equipped with radial coupling openings (24; 28) and the other housing (16 or 12) is equipped with axially parallel coupling openings (24; 28) accordingly – based on the axis of rotational symmetry (27) of the spring element (18).

5. The device according to Claim 1 or one of the following claims, characterized in that the spring element (12) is held on at least one of the two housings (12; 16) under a radial tension which causes its deflection out of the plane.

6. The device according to Claim 1 or one of the following claims, characterized in that the bottom of the tone generator housing (16) has a number of insertion openings (28) which correspond to the number of plug prongs (22) of the spring element (12), the distance between these insertion openings and/or their partial circle being somewhat smaller than that of the plug prongs (26).

7. The device according to Claim 1 or one of the following claims, characterized in that the insertion openings (24) on the device housing side are provided in the wall of a hollow cylindrical part (23) of the housing (12).

8. The device according to Claim 7, characterized in that the inside diameter of the hollow cylindrical part (23) of the device housing (12) is slightly smaller in the area of the insertion openings (24) than the partial circular diameter of the end edges (25) of the arm

sections of the spring element (12) that are broadened with respect to the plug prongs (22).

9. The device according to Claim 9, characterized in that the device housing (12) has a supporting ring (21) for flush-mounted installation.

10. The device according to Claim 9, characterized in that the bottom part of the device housing (12) which supports the device insert is formed only by the spring element (18).

11. The device according to Claim 9 or 10, characterized in that the device housing (12) consists only of the supporting ring (21) and the hollow cylindrical housing part (23) which is bonded to it and it can be closed toward the outside by a covering cap (14).

This invention relates to an electroacoustic device having a device housing and an electroacoustic transducer, whereby the housing of the transducer and the device housing are held at a distance from one another and are joined together in a resonance-free manner by a plastic spring element connectable to them by a plug connection.

Devices of this type in the form of electroacoustic signaling devices are known in numerous embodiments, using pin energizer systems having a bell shell or with sound rods or, recently also, piezoelectric tone generators are used. In all cases sound is generated by the fact that oscillation is induced in an oscillating component of the sound of the tone generator, i.e., the bell shell, the sound rods or the membrane of a piezoelectric tone generator, and this in turn excites vibration of a column of air, which then travels to the ear.

The converse principle whereby sound waves are converted into electric currents is used in a microphone which is thus a device having an electroacoustic transducer. Examined German Patent 20 52 443 proposes a coupling element, optionally to be manufactured as a single part made of plastic which has a rigid part and elongated springs mounted thereon to function as the decoupling element to be provided between the microphone capsule and a standing base. The rigid part has a plug prong which protrudes perpendicularly out of the plane of the springs for insertion into the standing base and optionally spoke-like arms protruding rigidly with the springs designed in the form of circular ring segments attached to the ends of the spokes.

In the known device, the plug prong takes up a great deal of axial space on the rigid part of the decoupling element. Manufacturing of the decoupling element as an injection molded plastic part is unfavorable first because of the enormous variation in material thicknesses in the area of the very thin springs and second because of the very bulky rigid part.

Based on an electroacoustic device of the type presupposed in the preamble here and disclosed in German Patent 20 52 443, the object of the present invention is essentially to design

the decoupling element in a skillful manner so that it takes up less axial space and is easy to handle in terms of the injection molding technology. The goal of the present invention is in particular to be able to use the decoupling element to advantage in a flush-mounted signaling device, e.g., a so-called "second alarm."

This object is achieved according to this invention by designing the spring element as a star having several arms, whereby the arms are alternately provided with plug prongs for connecting to the device housing on the one hand and the transducer housing on the other hand.

This results in a decoupling element that is designed on the whole as a spring element without any rigid parts. The arms which were previously rigid are now the individual spring elements of the multi-armed star. The entire component can therefore be manufactured essentially with the same wall thickness at all points. Due to the plug prongs arranged on all arms, this permits a simple connection that is free of outside fastening means to the two adjacent components, the device housing on the one hand and the transducer housing on the other hand, in an especially simple manner.

An extremely flat design is achieved if all the arms of the spring element lie essentially in the same plane.

The plug prongs are expediently arranged on the free ends of the arms of the spring element and are designed as tapered portions of the arms extending in the radial direction and/or across the plane of the star. The plug prongs may therefore be plugged into the corresponding housing in the radial direction of the arms and/or in a direction parallel to the axis of rotational symmetry of the star. Depending on the arrangement of the plug prongs made, the housing parts may thus be connected concentrically one inside the other or with one in front of the other in the axial direction.

It is expedient if the star has six arms, of which alternately one arm on the free end has a prong which tapers radially and the other arm has a prong which protrudes from the plane of the star and one of the two housings is equipped accordingly with radial coupling openings and the other is equipped with axially parallel coupling openings, based on the axis of rotational symmetry of the spring element. This results in an essentially radial contact engagement of the spring element with the one housing part and a rotationally axially parallel engagement of the arms that are arranged in alternation in the circumferential direction with the other housing. Each housing is thus coupled to three arms to which it is connected by plug connection via the spring element, with three other arms connected by plug connection to the other housing. This results in a statically very stable arrangement even when the spring element itself is designed to be relatively weak and thus inexpensive.

Furthermore, a particularly advantageous feature of this invention provides for the spring

element to be held on at least one of the two housings under a radial tension which causes it to be deflected out of the plane. This achieves the result that it holds the two housings at a distance from one another merely because of the deformation of the spring element which necessarily occurs in assembly. This occurs even if the (undeformed) spring element is essentially a flat structure and is arranged in the immediate bordering area between the two housings. The tone generator housing which is thus set in vibration therefore cannot come in direct contact with the device housing even at a large vibration amplitude.

The bulging out of its plane that results in the connection of the spring element to one and/or the other housing may be accomplished easily, for example, by the fact that the bottom of the tone generator housing has a number of plug prongs of the spring element corresponding to the number of plug openings and the distance between them and/or their partial circle is slightly smaller than that of the plug prongs. At the same time or as an alternative, it is also possible to have an arrangement in which the plug insertion openings on the device housing side are arranged in the wall of a hollow cylindrical part of a housing whose inside diameter is slightly smaller than the partial circle diameter of the end edges of the arm section of the spring element which is widened in comparison with the plug prongs.

In any case, the mounting of the respective arms of the spring element – as seen in the radial direction of one arm – is at a shorter distance from the midpoint of the spring element than would correspond to the actual length of the undeformed arm. Therefore the spring element is necessarily deformed out of its original plane. This deformation can be accomplished by corresponding coupling connections to one and/or the other housing part.

The device housing may also have a supporting ring for flush mounted assembly, whereby the bottom part of the housing which supports the device insert may be formed only by the spring element itself, so the entire device housing may consist only of the supporting ring and the hollow cylindrical housing part bonded to it, which can be sealed to the outside by just a covering cap.

This invention is explained in greater detail below on the basis of an exemplary embodiment shown in the figures. The figures show:

Figure 1 is a schematic view of a signaling device designed as a flush-mounted device and

Figure 2 is an exploded diagram of the two essential parts of the device and the spring element connecting them.

Figure 1 shows a wall recess 10 which is usually lined with a mounting box (not shown here) in the interior of which the electric feeder lines end and in which the device is held, e.g., with spreading clamps. The signaling device, labeled as 11 on the whole, consists of a pot-

shaped or ring-shaped device housing 12 in which an electronic circuit configuration is accommodated as a module; it also consists of a tone generator 13 and a cover or covering cap 14 resting on the wall level 15 (shown with dotted lines). Of the tone generator 13, only the tone generator housing 16 can be seen in the drawings. It contains essentially a piezoelectric crystal and a membrane as well as an electric feeder line (also not shown) which leads to the electronic circuit in the device housing 12.

As this shows, the device housing 12 and the tone generator housing 16 are held a distance 17 apart. This is accomplished with the help of a spring element 18, which is designed as an injection molded part and is provided with arms 19 and 20 in the exemplary embodiment, whereby the arms 19 of the tone generator housing 16 hold the housing and the arms 20 are attached to the device housing 12.

In the exemplary embodiment shown here, the device housing 12 consists of a supporting ring 21 and a cylindrical housing part 23, which is molded onto it in one piece and does not have a bottom. The supporting ring 21 serves to fasten the device 11 in the wall recess 10 – as is customary with other flush-mounted devices, e.g., flush-mounted plug boxes or switches. An electronic circuit configuration constructed on a circuit board is accommodated as the device insert in the space outlined by the ring-shaped part 23.

As shown in Figure 2, the spring element 18 which is provided for acoustically isolated connection of the tone generator 13 to the device housing 12 is designed in a star shape having six arms, namely an arm 19 and an arm 20 arranged in alternation in the circumferential direction. The arms 20 have tapered ends and thus form plug prongs 22 directed radially which are used for insertion into corresponding slotted recesses 24 in the device housing 12. The arrangement may be made in such a way that the radial distance of the end edge 25 of an arm 20, which is broadened with respect to the plug prong 22, from the midpoint M is slightly larger than the inside radius of the device housing 12 in the area of the plug recesses 24. When in this case the plug prongs 22 of the arms 20 are inserted into the respective recesses 24 in the device housing, the three arms 20 are under a radial prestress which causes the spring element to bulge out of its originally planar shape.

The arms 19, however, have plug prongs 26 which extend outward out of the plane of the undeformed star approximately in parallel with the longitudinal center axis of the device (indicated by 27). Accordingly, the tone generator housing 16 has three similarly aligned coupling recesses 28. The arrangement may be made here so that the radial distance of a plug prong 26 from the midpoint M of the star is slightly smaller than the radial distance of a coupling recess 28 from the midpoint 29 of the partial circle connecting all three recesses 28. Again in this case, the arms 19 are then put under radial prestress with the result that the arms 19 bend out of

their former plane.

The prestressed mounting of the spring element 18 may be in the manner described here, either mounted on one of the two housings 12 or 13 or mounted on both housings at the same time. It is essential that the distance 17 in Figure 1 must be great enough that with the vibrational amplitudes normally occurring with the tone generator 13, it does not come in contact with parts of the device housing 12.

In a preferred embodiment, the arrangement in this regard is made so that only the plug prongs 26 of the arms 19 are connected to the tone generator housing under a radial prestress so that the only bulging is that of the arms 19. In deviation from the diagram in Figure 1, the arms 20 would then lie essentially parallel to the end face edge 30 of the device housing 12. This arrangement is especially expedient because then the star-shaped spring element 12 can secure the device insert reliably in the direction of the signaling device longitudinal axis 27 so that the device housing 12 need not have any bottom.

The spring element 18 expediently consists of a one-piece injection molded plastic part with an arm cross section of 5×1 mm, for example. The plastic is selected in coordination with the geometry of the spring element so that first the desired spacer function is ensured and on the other hand the spring element has a spring constant which rules out resonance with the oscillation of the tone generator.

The arrangement of the tone generator 13 of the instrument housing 12 so that the tone generator is arranged axially with respect to the axis 27 and the arrangement of the tone generator 13 on the inside of the wall offer the advantage that the electric or electronic module can be accommodated close to the wall surface 15 in contrast with the device housing 12, so that it is possible in an especially simple manner to arrange the access in the covering cap 14 for actuation of potentiometers of the module, thus making it possible to regulate the duration of the sound and the sound frequency accordingly. Likewise, a light-emitting diode, which is visible in the covering cap, may be wired, for example, directly on the electronic circuit board of the device insert to also display visually the alarm call coming in. This would be possible in the case of a tone generator 13 mounted on the inside or outside only if this were not much smaller in diameter than the device housing 12, only thereby ensuring an adequate reach-through space for said devices.

Plus 2 pages of drawings

FIG. 1

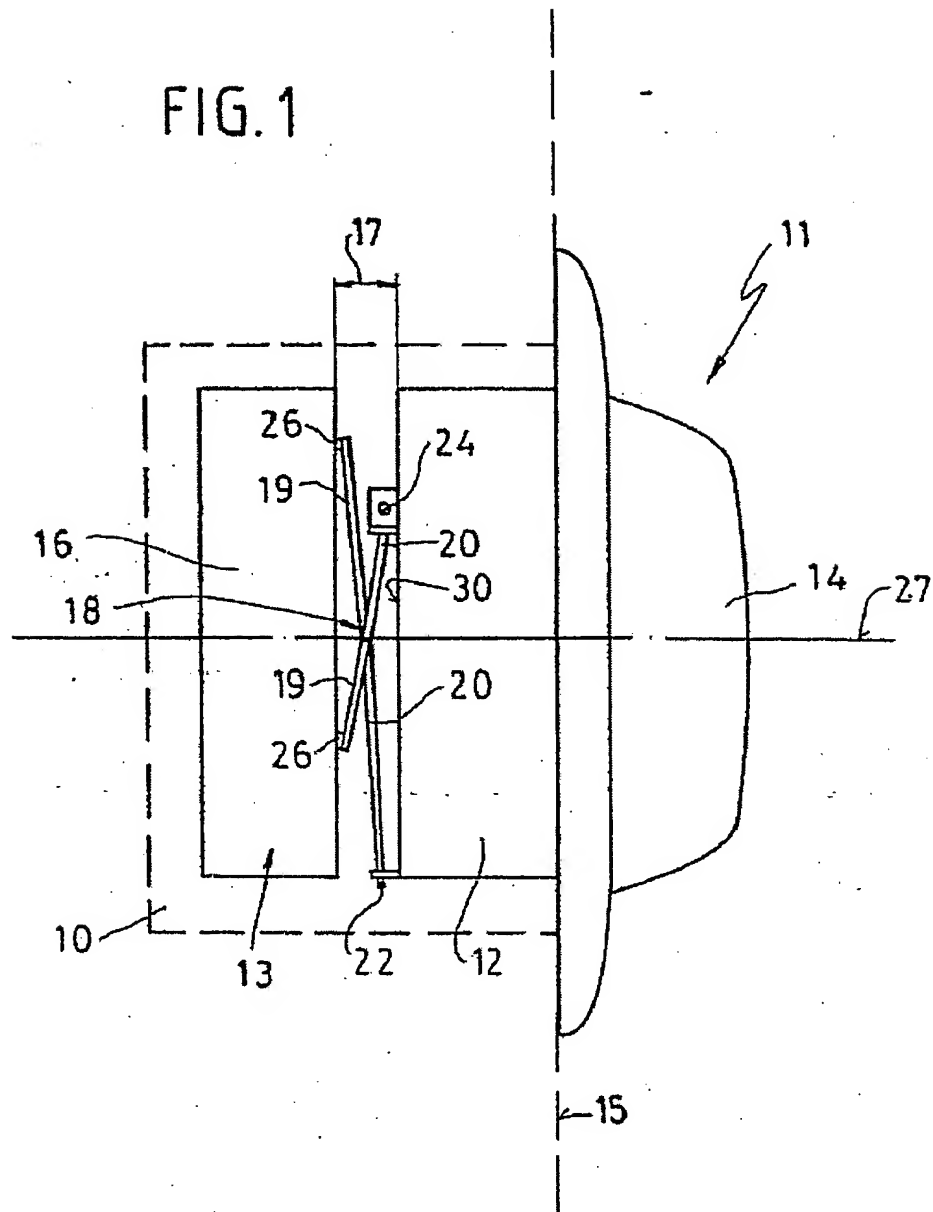


FIG. 2

